# FEDERAL UNIVERSITY OF TECHNOLOGY AKURE
## SCHOOL OF SCIENCE
## DEPARTMENT OF BIOLOGY

# A LECTURE ON ALGAE

BY
MR.ABIYA, S.E.

# INTRODUCTION

- Algae are a polyphyletic group that includes several smaller monophyletic groups with fossil record dating to the Precambrian about 1.2 - 1.4 billion years ago.

- Most algae use photosynthesis at least part of the time.

- Algae are subdivided by their type of wall, photosynthetic pigments, and method of food storage.

- Photosynthetic pigments and storage of sugars are quite diverse within the algae.

- Algae are major components of the phytoplankton, an important source of oxygen and the base of many food webs in the oceans and freshwater.

- Body styles range from single-celled to colonial (possibly simple multicellular).

# CHARACTERISTIC OF ALGAE

- The groups of protists called algae are considered plant-like because their members contain photosynthetic pigments.

- Algae differ from plants because they do not have roots, leaves or other structures typical of plants.

- The light-absorbing pigments of algae are found in chloroplasts.

- In many algae, the primary pigment is chlorophyll, which is the same pigment that gives plants their characteristic green colour.

- Many algae also have secondary pigments that allow them to absorb light energy in deep water.

- As water depth increases, much of the sunlight's energy is absorbed by the water.

- These secondary pigments allow algae to absorb light energy from wavelengths that are not absorbed by water.

- Because of these secondary pigments light at different wavelengths, algae are found in variety of colours.

# CLASSIFICATION

- The great diversity of algae makes the classification of algae a challenge.

- Algologists usually use three criteria to classify algae. These are:
  - ❖The type of the chlorophyll and secondary pigments
  - ❖The method of food storage and
  - ❖The composition of the cell wall

# EUGLENOPHYTA

- Organisms in the Euglenophyta have two flagella, a contractile vacuole, a photoreceptive eyespot, several chloroplasts, lack a cell wall, and can live as autotrophs or heterotrophs.

- Some autotrophic species of *Euglena* become heterotrophic when light levels are low.

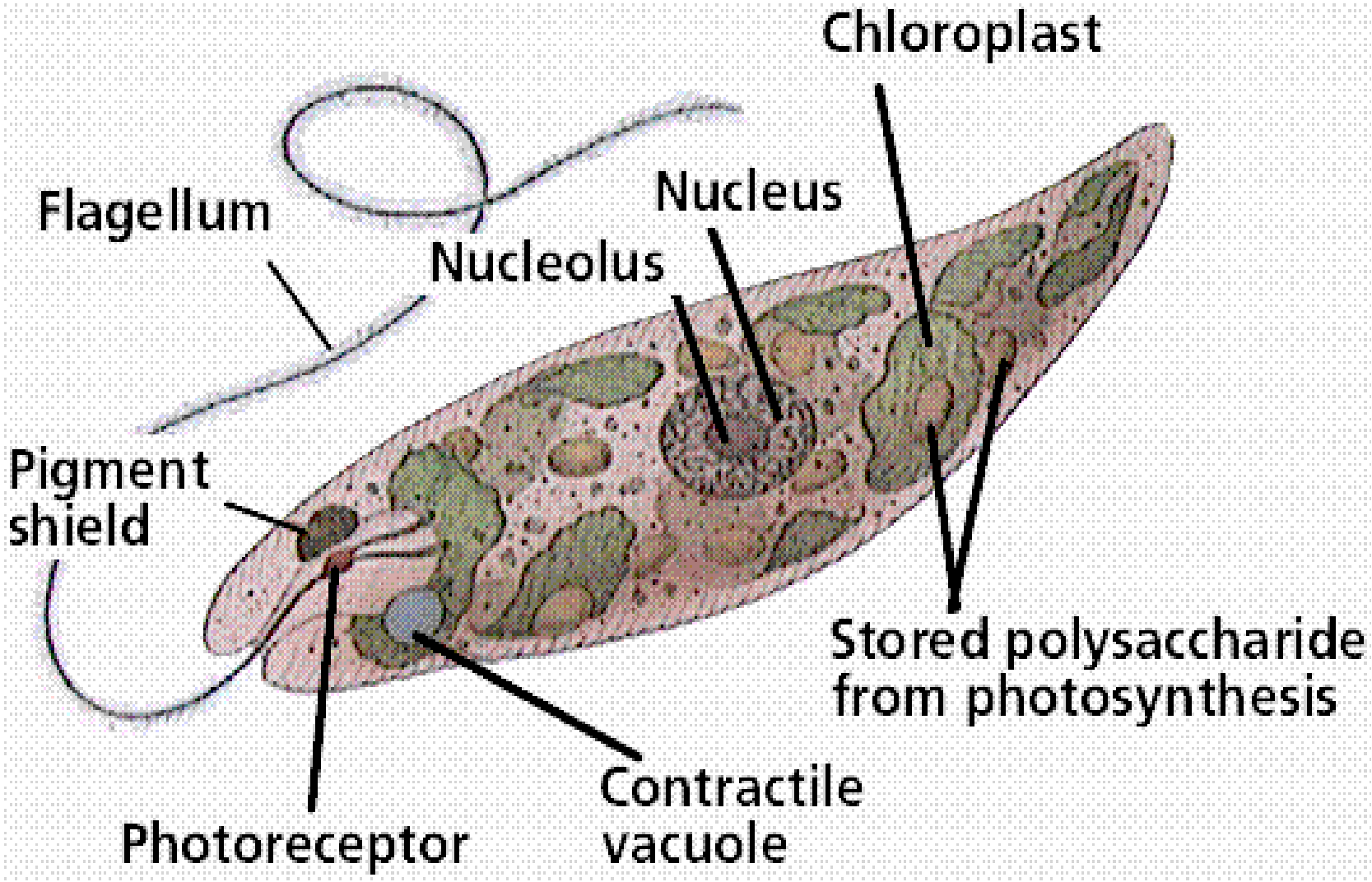



Fig. 1: The structure of *Euglena*, a flagellated protistan.

# CHRYSOPHYTA

- This group of freshwater, marine, and terrestrial algae includes the golden brown algae and diatoms.

- Food is stored as oils, and photosynthetic pigments include chlorophyll *a* and *c* and yellow carotenoid pigments.

- Diatoms secrete a silicon dioxide shell (called a frustule) that forms the fossil deposits known as diatomaceous earth, which is used in filters and as abrasives in polishing compounds.

- Diatoms divide into two groups, the pennaleans with bilateral symmetry and elongated shape, and another, the centraleans, with radial symmetry and a rotund shape.

- Certain diatoms also are important indicators of water quality, while others are useful fossils for age-dating Quaternary deposits.

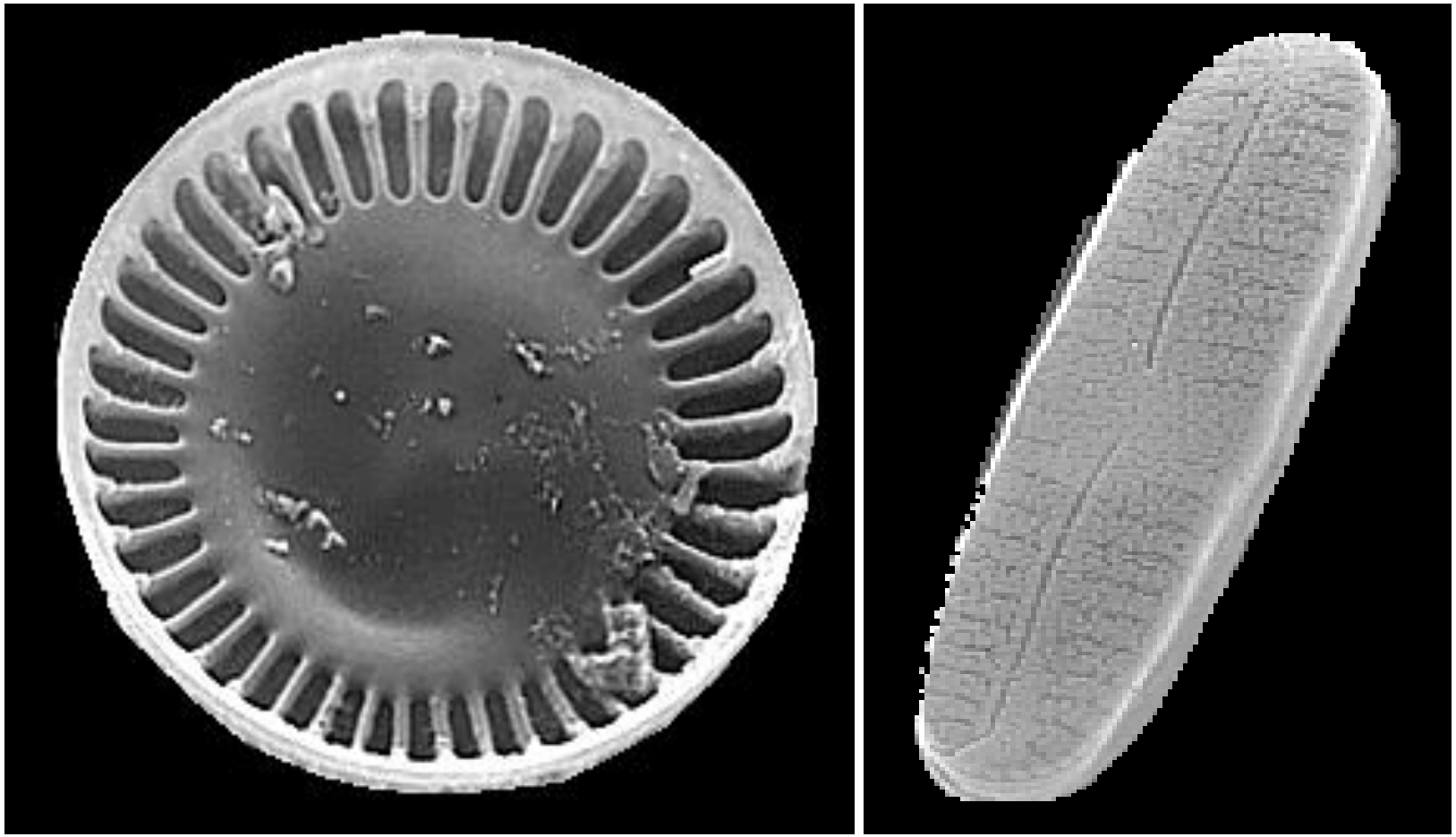


Fig. 2: Scanning electron micrographs of a centralean (right) and pennalean (left) diatom.

# PYRROPHYTA, THE DINOFLAGELLATES

- Dinoflagellates have two flagella emerging near the middle of the cell, one girdling the cell's girth, the other trailing parallel to the cell's long axis.

- Members of this group have cell walls and store excess sugars as starch.

- Some dinoflagellates also are "armored", having numerous plates that cover the cell.

- Ornamentation on these plates can be quite beautiful.
- Certain dinoflagellates live symbiotically inside corals, and are known as zooxanthellae.
- Most dinoflagellates are autotropic, with chlorophyll *a*, chlorophyll *c*, a unique pigment peridinin, and other carotenoids.
- Some dinoflagellates are heterotrophic.

- Cell division in dinoflagellates differs from most protistans, with chromosomes attaching to the nuclear envelope and being pulled apart as the nuclear envelope stretches.

- During cell division in most other eukaryotes, the nuclear envelope dissolves.

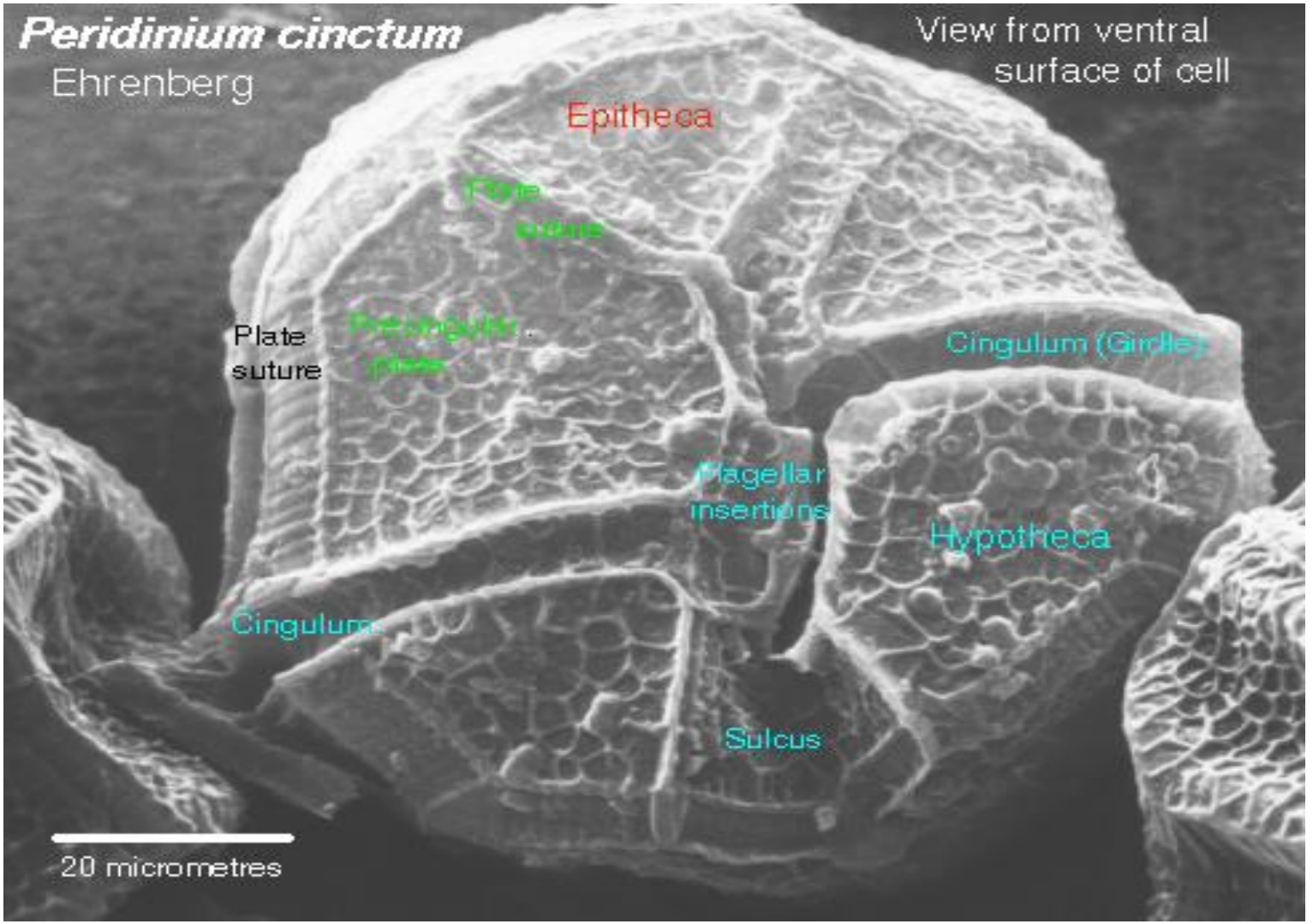



Fig. 3: Scanning electron micrograph of *Peridinium.*

- Red tides are caused by population explosions of certain dinoflagellates that release a neurotoxin into the environment.

- Shellfish concentrate this toxin and it can kill people who eat the contaminated shellfish.


Fig. 4: Red tides are population explosions of dinoflagellates.

# RHODOPHYTA, THE RED ALGAE

- Red algae have large amounts of the red pigment phycoerythrin, range from unicellular to multicellular, and sometimes more than one meter in length.

- Red algae are thought to have originated by symbiosis of Cyanobacteria (which also have phycoerythrin).

- Some red algae are important contributors to tropical reefs.

- Carrageenan is an additive to puddings and ice creams; dried sheets of red algae are used in some Japanese dishes.

Fig. 5: Red alga *Erythrophyllum delesseriodes* (left), *Microcladia coulteri* (right)

# PHAEOPHYTA, THE BROWN ALGAE

- Brown algae are multicellular, have the accessory pigment fucoxanthin (a brown pigment), and include the giant kelp that can be over 100 meters long.

- Brown algae are used in foods, animal feeds, and fertilizers and as a source for alginate, a chemical emulsifier added to ice cream, salad dressing, and candy.

- *Fucus* is a brown alga differentiated into a floating "blade", flotation bladder, stalk (or stipe) and basal holdfast. *Sargassum*, common in the Sargasso Sea region of the Atlantic Ocean, floats and maintains position by a flotation bladder filled with gas.

Fig. 6: Image of *Fucus* (left) and *Nereocystis* (right)

# CHLOROPHYTA, THE GREEN ALGAE

- Green algae have cellulose cell walls, chlorophyll *a* and *b*, store excess photosynthetic product as starch, and have long been considered the undoubted ancestors of plants.

- Body types in the green algae include unicellular to colonial and simple multicelluar.

- *Chlamydomonas* and similar cells appear to be a starting point within this group Autotrophic, unicellular forms with a single, cup-shaped chloroplast and two apically inserted flagella, these small cells also possess a contractile vacuole and pyrenoid.

- Excess sugars are stored as starch surrounding the pyrenoid.


Fig. 7: *Chlamydomonas*, a unicelled, biflagellated green alga.

# REPRODUCTION IN ALGAE

- Multicellular green algae have some division of labor, producing various reproductive cells and structures. *Ulva*, the sea lettuce, exhibits alternation of generations, producing free-living gametophyte and sporophyte forms.

- The common sea lettuce is usually haploid (the gametophyte) and reproduces asexually. Gametes are produced by mitosis, fuse, and produce a diploid zygote.

- The 2n zygote germinates and grows to become the sporophyte.

- Meiosis occurs in certain of the cells in the sporophyte, producing haploid swimming spores that will settle to the ocean floor and produce the next generation haploid gametophyte stage.

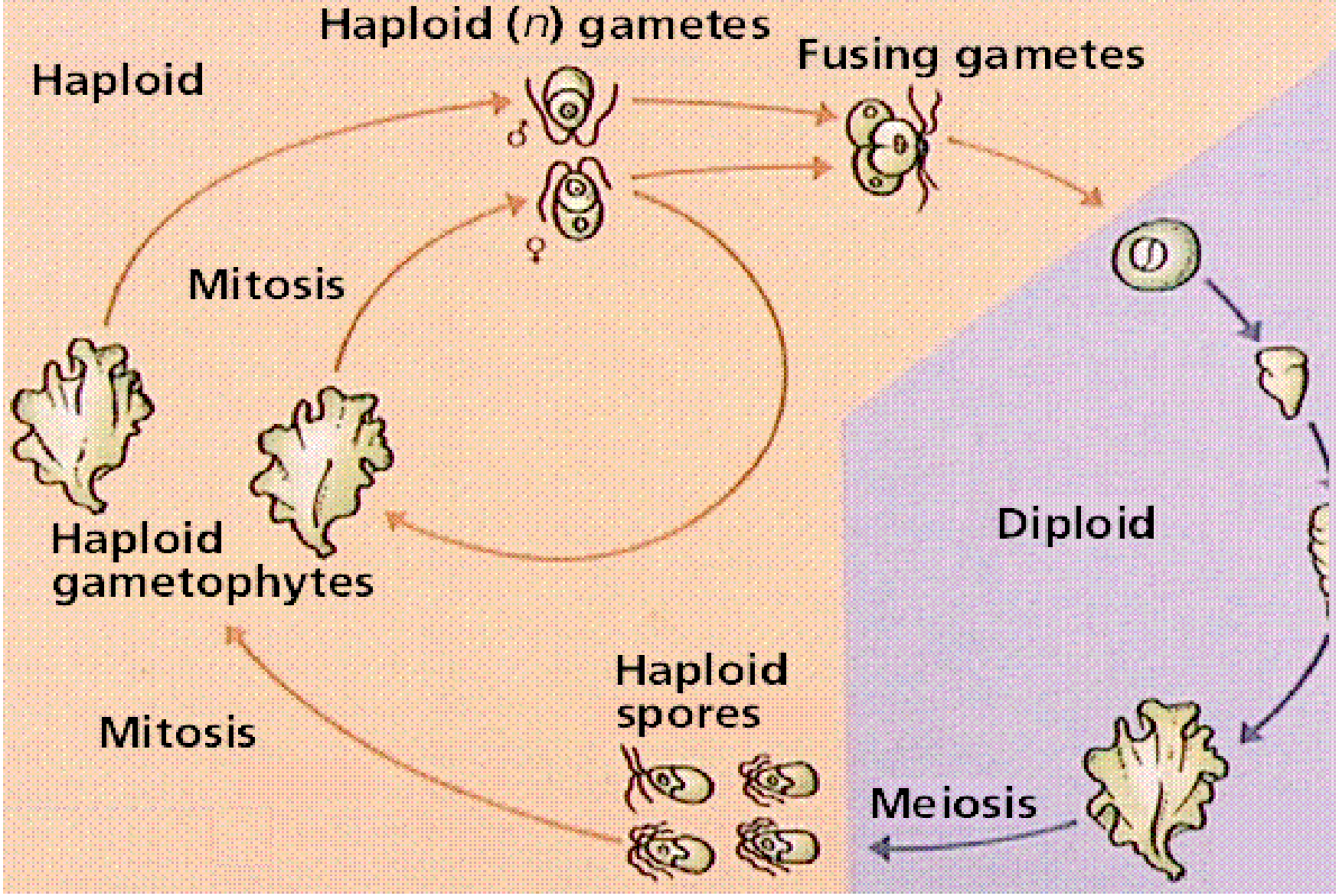
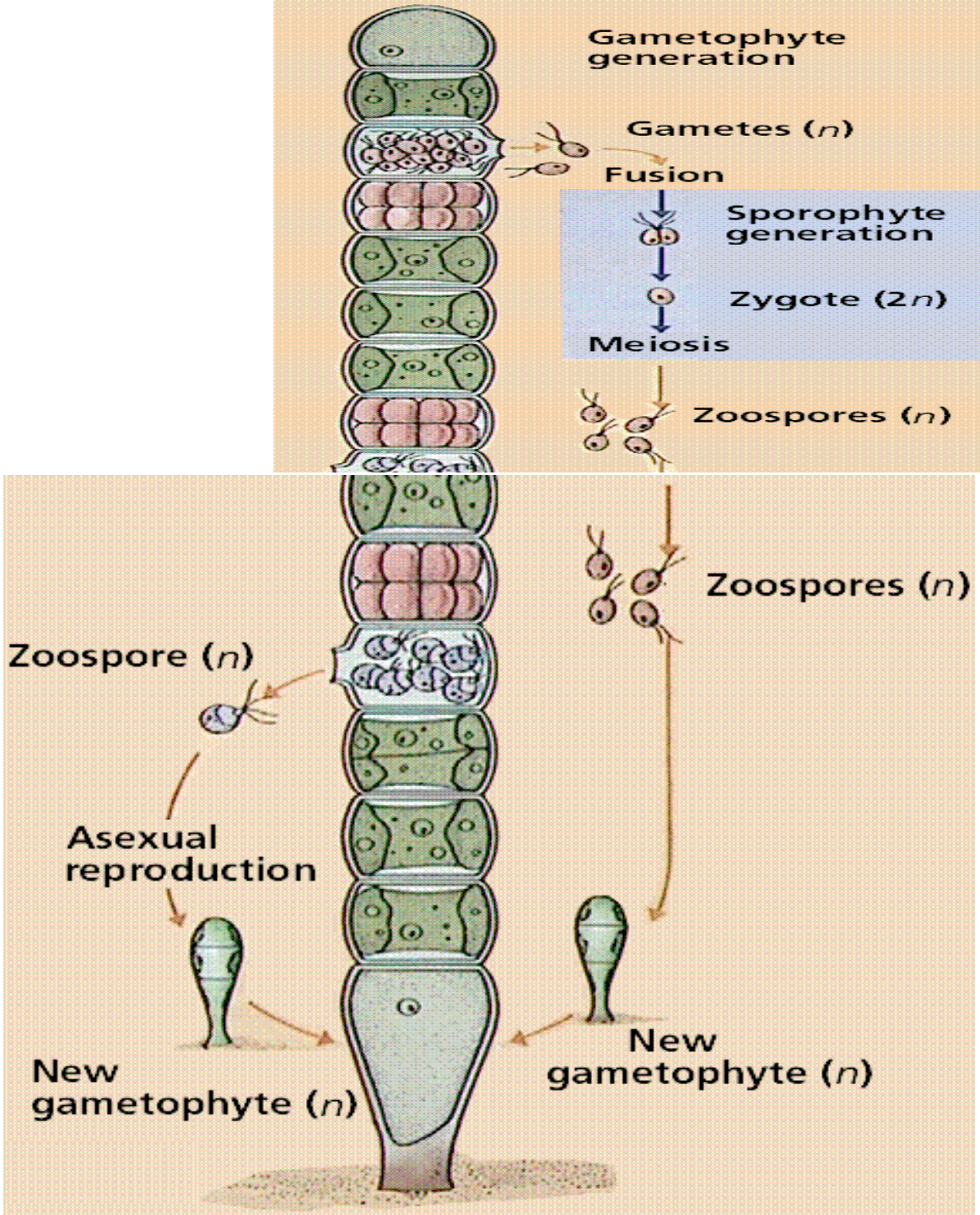



Fig. 8: Life cycle of *Ulva*, a multicelled green alga

- Filamentous algae produce gametes by mitosis within one cell of the filament.

- These gametes are released; fuse to form a diploid zygote that soon undergoes meiosis to produce haploid zoospores that swim, rest on the sea floor and develop into the next generation gametophyte phase.


Gametophyte generation
Gametes (n)
Fusion
Sporophyte generation
Zygote (2n)
Meiosis
Zoospores (n)
Zoospores (n)
Zoospore (n)
Asexual reproduction
New gametophyte (n)
New gametophyte (n)